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EGG STUDIES: I. SALT CURING OF CHICKEN AND DUCK EGGS

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ABSTRACT

Comparison between salt-cured duck and chicken eggs using solar coarse salt indicated that the resulting duck eggs yolks had a more pleasing orange color, less darkened due to iron sulfide formation and were more likely to acquire the desirable oil exudation (locally called 'aceite') than the chicken egg yolks. Rate of salt-curing was studied on duck eggs using industrial or purified salt (PS) and solar coarse salt (CS). Salt-curing of these eggs was at a faster rate in PS than CS. Storage studies over a fourteen week period showed no significant differences between PS- and CS-cured duck eggs based on subjective color, odor, texture, taste, general and commercial acceptability scores. At the end of the fourteenth week, it was observed that the salt-cured eggs' air cell increased to about 1/4 the size of the whole egg and shell became very brittle. However, the eggs were considered edible.

INTRODUCTION

Chicken and duck eggs occur in abundance in the Philippines during the dry season of December to May. During this period there is a surplus particularly in those areas isolated from populous or urban points due to lack of an organized marketing system for easy and fast collection and transport of eggs. This situation is aggravated by the fact that eggs are highly perishable. Chicken eggs have been found to keep at room temperature only up to 7 days without evidence of spoilage. No literature on shelf life of duck eggs has been found although eggs from Khaki Campbell ducks were reported by Rhodes *et al*[1)] to possess greater stability to deterioration than chicken eggs.

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Oil-coating of chicken eggs has been reported to extend their shelf life to 21 days at room temperature. Salt-cured chicken eggs may be kept at room temperature up to three months after which the air cell is increased to 3/4 inch, the chalazæ hardens and the albumen becomes rubbery.[2] Reyes and Minglana[3] compared the general acceptability of salt-cured chicken eggs at different salt-curing periods. However, they did not compare these eggs with salt-cured duck eggs. No literature report has been found on the shelf life of salt-cured duck eggs.

Salt-curing of duck eggs is a local cottage industry with profits of about thirteen million pesos (₱13,000,000) annually.[4] In fact, this has been viewed by some enterprising Filipinos as a good export potential. However, improved methods of salt-curing are yet to be developed to meet the strict demands of foreign ports of entry.

This present study was conducted in an effort to find new or better materials for salt-curing eggs in commercial scale. It aims to compare the eating qualities of salt-cured chicken and duck eggs and to determine the rates of salt-curing of duck eggs using solar coarse (CS) salt and industrial or purified (PS) salt. Shelf life of PS-cured and CS-cured duck eggs at the maximum salt concentration was also studied.

MATERIALS AND METHODS

Fresh duck and chicken eggs of the native (locally called *itik*) and Leghorn breed, respectively, and commercially salt-cured cooked duck eggs (without the customary red fuchsin dye on the shell) were procured directly from Laguna and Rizal duck or poultry farms. The fresh duck and chicken eggs were salt-cured within 30 hours after lay. Commercial iodized salt (PS) and coarse salt (CS), procured from a local supermarket, were used for curing.

Comparison between salt-cured chicken and duck eggs. – Four to five eggs of each type were used in this comparative study. Duck and chicken eggs were salt-cured for 19 days in a similar manner as that described in the subsequent paragraph. The chicken eggs were hard-cooked for 15 minutes at 100°C while the duck eggs were hard-cooked for 30 minutes at the same temperature.

Rate of salt-curing of duck eggs. – A 1:1 (by weight) solution of CS or PS and boiling tap water was prepared in two separate

one-gallon jars, shaken and allowed to cool overnight. Twenty randomly selected duck eggs were rinsed with tap water to free them from any visible fecal contamination and were immediately immersed in each jar. A polyethylene bag filled with the same 1:1 CS or PS solution served as weight to keep the eggs immersed in the brine. Eggs were randomly taken out from each of the jars at 7, 14, 19, and 21 days of salt-curing at room temperature, were hard-cooked at 100°C for 30 minutes and rapidly cooled under running tap water. The cooled eggs were cut in half and their yolks carefully separated from their albumen. Yolks and albumen were separately analyzed for per cent sodium chloride content. A quarter from each of these eggs was set aside for the evaluation of organoleptic properties by two to three panel members.

Per cent sodium chloride content of the cooked yolk and white was determined by the use of Quantab Chloride titrators 1176 from Ames Co., Elkhart, Indiana.[5]

Storage life of CS- and PS-cured duck eggs. – The cooked salt-cured duck eggs at their established maximum sodium chloride concentration were stored over a period of 14 weeks. At 2-week intervals, they were evaluated organoleptically and objectively for yolk color and were examined microbiologically.

Sensory evaluations. – Sensory evaluation of the egg products for storage study was carried out by a panel of 10 members. Taste panel members were selected on the basis of their training, availability, and cooperativeness. The Hedonic Rating Scale[6] was used in rating the various sensory factors. The panel members were asked to check "yes" or "no" in answer to the question whether they would purchase the egg products when sold commercially. In this paper, the number of members who responded "yes" to this query will be referred to as commercial acceptability scores.

Statistical analyses of the sensory evaluation scores were conducted by t-test.[7] Chi square test was used to statistically analyze the commercial acceptability scores.[8] Ten freshly prepared commercially salt-cured eggs (without the customary red fuchsin dye on the shell) were also presented to 10 panel members. Their general acceptability scores were compared with those of the CS- and PS-cured duck eggs.

Egg yolk color. – Two to three grams sample of egg yolk were measured accurately into a glass stoppered graduated cylinder. Reagent-grade acetone was added a little at a time till a total of 50 ml was reached. After adding the first 10 to 20 ml, the yolk particles were crushed with the aid of a glass rod and by intermittent shaking. The precipitated protein particles were allowed to settle for about 10 minutes and then filtered. Resulting yellow acetone extract was measured using Klett Summerson colorimeter with No. 42 (blue) filter. Reagent-grade acetone was used as a blank and a standard Beta-carotene curve was plotted. However, in this experiment, the Klett readings per tube were not converted to mcg. Beta-carotene per tube was used because the color integrity of the available Beta-carotene standard was quite dubious. However, the standard Beta-carotene curve obtained in this experiment was linear at the Klett colorimeter reading range of the yolk color extracts, indicating a strong relationship with the Beer-Lambert equation. Hence the objective color scores were expressed in Klett colorimeter readings.

Microbial examination. – The microbial quality of the eggs was determined by employing the official procedures of the American Public Health Association.[9] The analyses included the determination of total plate count, yeast and mold count, and the detection of the presence of *Salmonella – Shigella* organisms.

The total plate and yeast and mold counts were determined using pour plate methods in duplicates for each of three different dilutions incubated at room temperature for 24 to 72 hours. *Salmonella-Shigella* organisms were detected using direct inoculation method.

RESULTS AND DISCUSSION

Comparison between salt-cured chicken and duck eggs. – The resulting cooked CS-cured chicken eggs apparently did not possess the desirable orange color of the CS-cured duck eggs. In all the cases studied, there was no oil exuded among the chicken yolks unlike in the case of some of the duck yolks. This duck yolk oil exudate, locally termed "aceite" is a much-sought after quality of salt-cured duck egg by consumers in general. The chicken yolk was also more prone to darkening by sulfide formation which was in agreement with the finding of Rhodes *et al.*[1] These same workers

found less hydrogen sulfide evolution from the duck eggs than from the chicken egg. In this paper, any iron sulfide ring formation about the duck yolk might have been masked by its orange pigment.

The difference in the nature of duck and chicken feeds might explain the pigment difference between their egg yolks. It is known that birds are capable of passing on to their eggs the pigment obtained from their diets. Here in the Philippines, native ducks are fed with among other things, clams, shrimps, snails and other shellfish which may contain bright orange/red pigment of carotenoid nature. On the other hand, chickens are not fed with these. This contention is further supported by the fact that Rhodes *et al*[1)] obtained similar egg yolk color from ducks and chickens fed the same ration (sans snails and other shellfish) and raised under similar experimental conditions.

These differences between salt-cured chicken and duck eggs could very well be the reason for the popularity of salt-cured duck eggs over salt-cured chicken eggs in the Philippines. For this reason, salt-cured chicken eggs were not given much attention in this paper. However, the authors suggest the possible improvement of chicken yolk color to simulate that of duck eggs by experimental feeding with orange/red pigmented feeds. However, it might be pertinent to state that Marusich *et al*[10)] in the USA fed pure carotenoids to laying hens and obtained egg yolks with an orange tinge which they described as unacceptable. In this connection, the opinion of the authors of the present paper is that desirability of a color is quite subjective.

Rate of salt-curing of duck eggs. – Per cent sodium chloride of the yolk and albumen at the different salt-curing periods is shown in Figure 1. PS-cured eggs had faster rates of salt-curing both for white and yolk than CS-cured eggs. These results tallied with the sensory evaluation scores of 2 to 3 taste panel members. This was in agreement with the reports of Hamm[11)] and Madlansacay[12)] on fish and ham-curing, respectively, who compared rates of salt-curing of these type of foods using coarse salt and purified salt. A possible explanation for this may be the hindering effect of insoluble salts such as those of magnesium and calcium present in the coarse salt. Also, faster rates of salting of the albumen than of the yolk were shown both in CS and PS. This

is quite logical because of the greater proximity of the albumen than the yolk to the salt-curing solution and the albumen's higher water content (88 per cent) providing a greater aqueous medium for salt solution than that of the yolk (48 per cent). It is clearly shown in Figure 1 that per cent sodium chloride of the egg yolks reached its maximum at 19 days of salt-curing. This salt-curing period will be taken as the established length of salt-curing in a subsequent experiment described in this paper.

Specific gravity of the raw CS-cured yolks and whites was also determined at 8, 16, 19, and 21 days salt-curing and used as a check of the results in Figure 1. The specific gravity results are

FIG. 1. *Per cent sodium chloride of purified salt- and coarse-salt-cured duck albumen and duck yolk vs. days of salt-curing.*

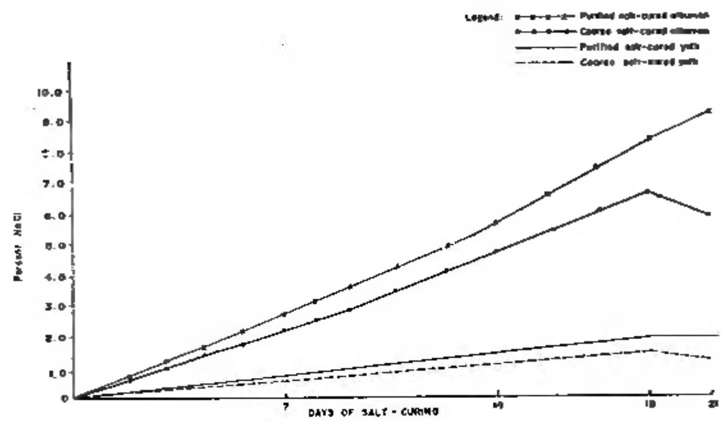
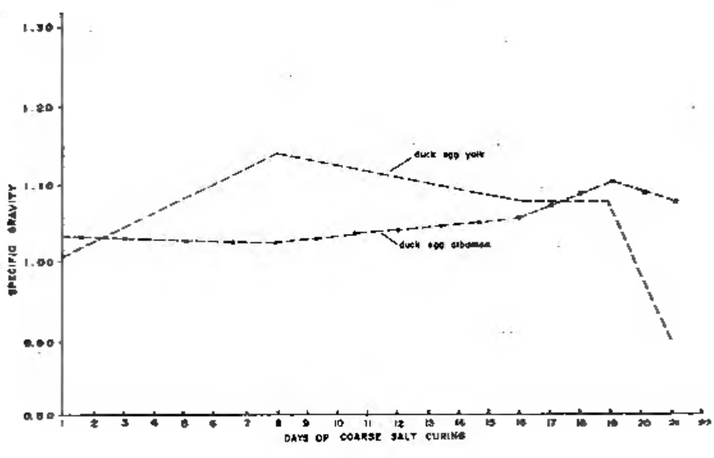


FIG. 2. *Specific gravity of coarse salt-cured duck albumen and duck yolk vs. days of salt-curing.*



shown in Figure 2. There was an increase of specific gravity of the albumen between the 8th and 19th days of salt-curing which tallied with its increase of per cent sodium chloride at these periods as shown previously. In the case of the specific gravity of the yolk, it increased drastically on the first week indicating water absorption from the albumen through the vitelline membrane after which there was a decline till the third week of salt-curing. The decline on the third week was drastic. The decrease of specific gravity might be due to plasmolysis of the yolk upon increase of the per cent sodium chloride of the albumen.

Comparison of texture and color of cooked PS- and CS-cured eggs at 7 and 14 days curing with an unsalted cooked duck eggs (all laid on the same day) showed that the PS- and CS-cured duck eggs both had a clean-white egg albumen and a desirable texture while the unsalted duck egg's albumen was rubbery and somewhat yellowish white. The rubbery texture of uncured duck albumen was also reported by Rhodes *et al.*[1] Therefore salt-curing improves the color and texture of duck eggs. It is common knowledge that hard-cooked unsalted chicken egg is not rubbery nor yellowish.

Prior to cooking of the salt-cured eggs, it was observed that the raw yolks were very firm at 19- and 21-day salt-curing. They were practically solid. There was no danger of rupturing the vitelline membrane because the yolk proteins seemed to have solidified. At the 8th and 16th days of salt-curing, the progressive degrees of solidification of the raw yolks were quite obvious. This observation further strengthens the contention that plasmolysis of the yolk occurs upon increase of per cent sodium chloride of the albumen.

It might be of interest to note that the pH of fresh raw egg white was 8.9 which decreased to 6.7 after 21 days of CS-curing. This decrease could be due to calcium chloride impurities in the salt. Yolks of the same CS eggs did not vary considerably in pH between fresh raw and raw 21-day CS-cured eggs which was about 6.4 pH data from raw PS-cured eggs were not obtained.

STORAGE LIFE OF CS- AND PS-CURED DUCK EGGS

Sensory evaluation. – T-test of the subjective evaluation scores such as color, odor, taste, texture and general acceptability of the CS- and PS–cured duck eggs (Table 1) as well as the Chi Square test of the commercial acceptability scores did not show

TABLE 1. *Sensory evaluation scores*[1] *of coarse salt-cured and purified salt-cured duck eggs.*

Storage periods (weeks)	Treatments: Coarse salt-cured eggs	Treatments: Purified salt-cured eggs	t-test
COLOR			
Zero	6.5	5.9	
Two	5.9	4.9	
Four	6.1	5.8	
Six	5.9	6.1	
Eight	5.8	5.4	
Ten	6.6	7.2	
Twelve	7.2	7.1	
Thirteen	6.9	5.3	***
Fourteen	4.8	5.7	
ODOR			
Zero	6.2	6.4	
Two	5.4	5.5	
Four	5.2	6.0	
Six	5.0	5.4	
Eight	6.0	5.9	
Ten	6.1	6.5	
Twelve	6.6	5.9	*
Thirteen	6.2	3.8	***
Fourteen	4.0	6.0	***
TASTE			
Zero	5.8	6.2	
Two	6.0	5.4	
Four	5.2	5.6	
Six	4.9	4.8	
Eight	7.0	6.8	
Ten	4.7	5.6	
TEXTURE			
Zero	5.7	5.7	
Two	6.1	5.6	
Four	5.5	5.5	
Six	5.7	4.7	
Eight	6.1	5.6	
Ten	5.2	5.1	
Twelve	6.6	6.1	
Thirteen	6.3	4.8	**
Fourteen	5.2	5.4	
GENERAL ACCEPTABILITY			
Zero	6.0	6.2	
Two	5.6	5.1	
Four	5.2	6.1	
Six	4.6	4.2	
Eight	6.0	6.0	
Ten	5.4	5.7	
Twelve	6.8	6.3	
Thirteen	6.3	4.3	***
Fourteen	4.6	5.4	

[1] Sensory evaluation score code following the hedonic scale:

* $p \leq 5$ per cent
** $p \leq 1$ per cent
*** $p < 0.5$ per cent

9 - like extremely
8 - like very much
7 - like moderately
6 - like slightly
5 - neither like or dislike
4 - dislike slightly
3 - dislike moderately
2 - dislike very much
1 - dislike extremely

any significant differences at the 5 per cent level between the two treatments (Table 2). After the tenth week, due to the dubious

TABLE 2. *Commercial acceptability scores* of hard-cooked coarse salt-cured and purified salt-cured duck eggs at different storage periods.*

Storage periods (weeks)	Treatments	
	Coarse salt-cured	Purified salt-cured
Zero	6	6
Two	7	4
Four	3	5
Six	5	4
Eight	5	6
Ten	7	5
Twelve	9	7
Thirteen	8	3
Fourteen	9	5

*The 10 panel members were asked to check "yes" or "no" in answer to the question whether they would purchase the cured eggs when sold commercially. The commercial acceptability score refers to the number of members who responded "yes" to this query.

overall quality of the samples, the panel members were not made to taste the samples any more. The panel members were merely made to indicate whether the eggs appeared edible or not. General acceptability scores of commercially salt-cured eggs were comparable to the corresponding scores assigned to the CS- and PS-cured duck eggs as shown in Figure 3. Towards the end of the

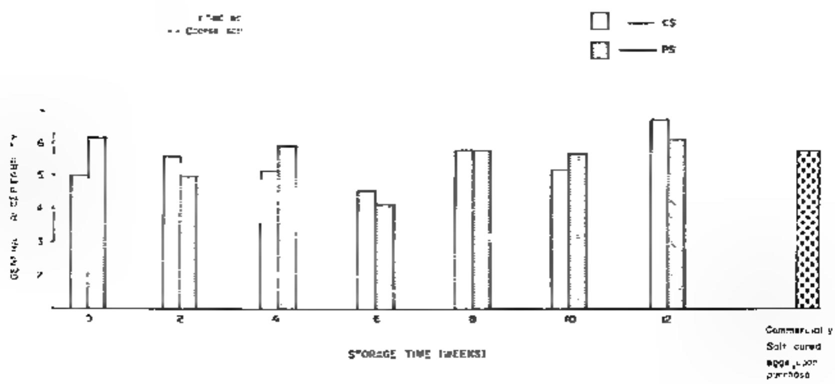


FIG. 3. *General acceptability (subjective) scores of hard-cooked PS*-and CS**-cured duck eggs vs. storage time.*

fourteenth week of storage, it was observed that the salt-cured egg's air cell increased to about 1/4 the size of the whole egg and the shell became very brittle. Hence the storage study was terminated. The authors of this paper suggest the combination of salt-curing and oil-coating as a possible remedy to prolong the storage life of the samples.

Egg yolk color. — Objective yolk color data of CS- and PS-cured duck eggs expressed as Klett reading followed a similar pattern as the subjective color scores as shown in Figure 4.

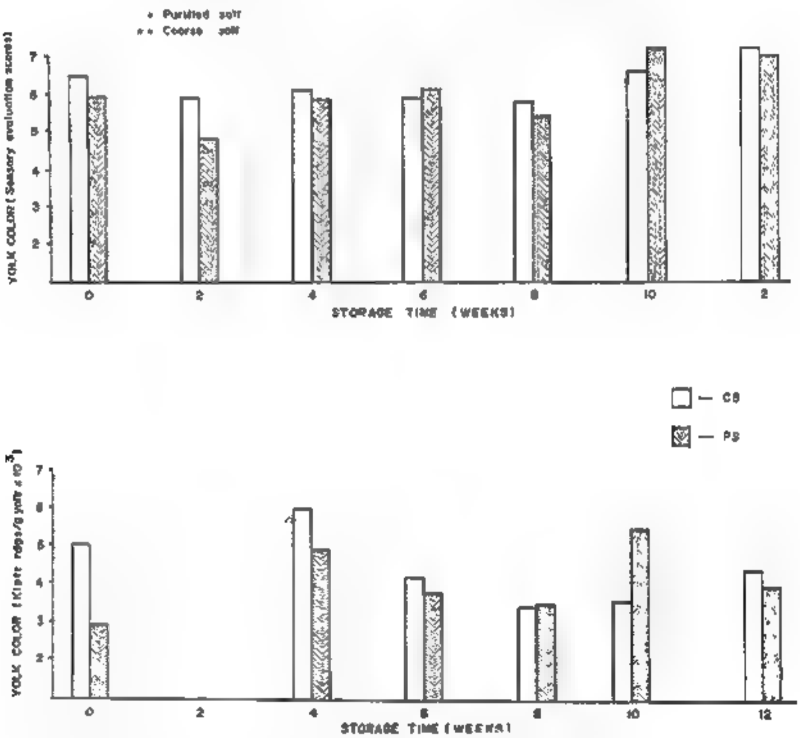


FIG. 4. *Subjective and objective color scores of hard-cooked PS* and CS** cured duck eggs vs. storage time.*

Microbial examination. Total plate counts at different storage periods are shown in Table 3. There is no available microbial standard for salt-cured eggs. However, based on the microbial standard for fresh eggs which is 5 x 10^6 bacteria per g,[13] throughout the 14 weeks storage period, 19 out of 33 CS-cured eggs (57.6 per cent) were within the microbial standard while 17 out of 33 PS-cured eggs (51.5 per cent) were within the standard.

TABLE 3 *Total plate counts (TPC) of coarse salt-cured and purified salt-cured duck eggs throughout fourteen week storage period.*

Total no of eggs	TPC at 48 hours incubation (bacteria per g)	$\leqslant 10^2$	10^2	10^4	10^5	$<5x\ 10^{6a}$	$>5x\ 10^6$	10^7	10^8	$\geqslant 10^9$
	Storage time and treatments	No of eggs								
	Zero week									
3	Coarse salt cured					1		1	1^b	
3	Purified salt cured					1			2^b	
	Two weeks									
3	Coarse salt cured				1	1			1	
3	Purified salt cured							1	2	
	Four weeks									
3	Coarse salt cured								1	2
3	Purified salt cured					1				2
	Six weeks									
2	Coarse salt cured	2								
2	Purified salt cured			2						
	Eight weeks									
2	Coarse salt cured		1				1			
2	Purified salt cured							1		
	Ten weeks									
4	Coarse salt cured					1			1	1
4	Purified salt cured		1		1	2				
	Eleven weeks									
4	Coarse salt cured				1	1				2
4	Purified salt cured				1	1				2
	Twelve weeks									
4	Coarse salt cured					1^c		3^d		
4	Purified salt cured					2	1	1		
	Thirteen weeks									
4	Coarse salt cured					4^e				
4	Purified salt cured							2^c		2^e
	Fourteen weeks									
4	Coarse salt cured			2^c		2^e				
4	Purified salt cured			4^c						

[a]Above this count is substandard for liquid eggs
[b]TNTC at 10^{-4} dilution
[c]plus spreader
[d]one of them had a spreader
[e]two eggs in one sampling

Yeast and mold counts at different storage periods are shown in Table 4 They tended to decrease with length of storage time.

All the eggs were negative to the *Salmonella-Shigella* test.

It may be concluded that under the conditions of the experiment, PS-cured duck eggs are not necessarily superior microbiologically over CS-cured duck eggs.

Other observations include at the 4th and 8th week storage period, 2 CS-cured eggs were very dark simulating the color of century eggs which were definitely objectionable in appearance and odor if the eggs were to be classified as salt-cured eggs. This might be due to inclusion of a few not-so-fresh eggs into the original sampling.

TABLE 4. – *Yeast and mold counts (YMC) of coarse salt-cured and purified salt-cured duck eggs throughout 14 weeks storage period*

Total no. of eggs	YMC at 72 hours incubation (colony per g)	Number of eggs								
	Storage time and treatment	Zero	10	10^2	10^3	10^4	10^5	10^6	10^7	-10^8
	Zero week									
3	Coarse salt-cured	1	1	1						
3	Purified salt-cured		1		2					
	Two weeks									
3	Coarse salt-cured	2				1				
3	Purified salt-cured	1					1	1		
	Four weeks									
3	Coarse salt-cured	2								1
3	Purified salt-cured	1						1		1
	Six weeks									
2	Coarse salt-cured	2								
2	Purified salt-cured	1				1				
	Eight weeks									
2	Coarse salt-cured	1			1					
2	Purified salt-cured	2								
	Ten weeks									
4	Coarse salt-cured	2			2					
4	Purified salt-cured	1			1	2				
	Eleven weeks									
4	Coarse salt-cured	4								
4	Purified salt-cured	3			1					
	Twelve weeks									
4	Coarse salt-cured	2				2				
4	Purified salt-cured	3				1				
	Thirteen weeks									
4	Coarse salt-cured	4[a]								
4	Purified salt-cured	4[a]								
	Fourteen weeks									
4	Coarse salt-cured	4[a]								
4	Purified salt-cured	2[a]			2[a]					

[a]Two eggs pooled per egg sample.

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REFERENCES

(1) M B Rhodes, J. L. Adams, N. Bennett, and R E. Feeney, *J Poult Sci* **39** (6) (1960), 1473.

(2) P. L Madlansacay, F S Mensaivas, and R Aducayen, unpublished work

(3) I A Reyes, and A. R Minglana, *Araneta J. Agric.* **16** (1969), 206

(4) C. W. Frazier, *Free World*, **2** (11) (1953), 10

(5) L J Vander Werf and A. H Free, J. Assoc Official Agric Chem , **53** (1970), 47.

(6) D R Peryam, *Lab Pract.*, **13** (7) (1964), 605.

(7) F E Croxton and D. J Cowden, Applied General Statistics. Second ed. New Jersey Prentice-Hall, Inc., 1955, p. 653.

(8) J. C. R Li, Statistical Inference I Ann Arbor, Michigan Edward Brothers, Inc., 1964, p 467

(9) American Public Health Association. Recommended Method for the Microbial Examination of Foods. New York. American Public Health Association, Inc , Chapter 8, 1968, p. 73.

(10) W Marusich, E. de Ritter, and J. C Bauernfeind, *J. Poult, Sci.*, **39** (6) (1960), 1338

(11) Wm. Hamm, *Philipp Chem. Eng. J* , **2** (1) (1949), 41.

(12) P. L. Madlansacay, *BAI Recorder*, **25** (1965), 25

(13) C. W. Frazier, Food Microbiology, 2nd ed New York: McGraw-Hill Book Co., Inc., 1967, p 512.

NUTRITIONAL IMPROVEMENT OF RICE DIETS

I. EVALUATION OF DIETARIES OF 15 HOUSEHOLDS*

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ABSTRACT

Four food groups were found adequately supplied to Laguna households. Foods inadequately consumed were as follows: Starchy roots and tubers, sugars and syrups, dried beans and nuts, leafy and yellow vegetables, vitamin C-rich foods, milk and milk products, and fats and oils. Evaluation of per capita food intake in Laguna was made by using a computer program developed by the Los Baños Computing Center, UPLB.

INTRODUCTION

A nutrition survey of the Southern Tagalog (ST) region was conducted by the Food and Nutrition Research Center (FNRC) from January to April 1962.[1] The nutritional status established for the region covers eight provinces, namely, Batangas, Cavite, Laguna, Marinduque, Mindoro Occidental, Mindoro Oriental, Quezon, and Rizal. The survey covered a composite sample of 27 poblaciones and cities and 51 barrios or a total of 368 households (2,502 persons). Laguna, the province of interest for the present nutritional study was represented by five poblaciones and cities and nine barrios or a total of 74 households (101 persons).

It is presumed that dietary patterns vary from province to province. To confirm this, dietaries of Laguna households were evaluated and compared with those of the ST Region in order to arrive at a more definite picture of the nutritional status of the province.

PROCEDURE

A subsample of the FNRC sample households in Laguna was drawn by random selection. The 74 households were first

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classified into rural (barrio) or urban (poblacion or city) level Twenty per cent of the households in each level were chosen, seven households from the 35 rural households and eight from the 39 urban households, or a total of 15 households to represent Laguna province. Data on these 15 Laguna sample households obtained from the FNRC and composition of food items[2] in their diets were coded and recorded in IBM cards. A program for IBM 1620 was developed at the Los Baños Computing Center (LBCC) to calculate diet ratings in accordance with the Manual of Instructions for the Nutrition Survey,[3] i.e.,

$$\text{Adequacy, per cent} = \frac{\text{Total food or nutrient intake}}{\text{Recommended daily allowance}} \times 100$$

Diet rating, per cent = Average of nutrient adequacy (per cent) of nine nutrients, namely, calories, protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin and ascorbic acid

When the nutrient adequacy exceeded 100 per cent, the value used for computing diet rating was pegged at 100 to prevent undue weighting of any nutrient.

RESULTS AND DISCUSSION

Comparison of the 15 Laguna subsample households and the ST sample revealed that they did not differ considerably from each other in terms of the age and sex of their respective population groups. The young (0–20 years) made up approximately 60 per cent of the population in each group of households; the adults, about 40 per cent. The sexes were almost evenly distributed, 50–50.

The lower limit of 90 per cent adequacy was chosen as the cut-off point for determining dietary deficiencies, i.e.,

$$\frac{\text{Actual Intake}}{\text{RDA}} \times 100 = 90 \text{ per cent.}$$

Whereas Laguna per capita food intakes (Table 1) met the RDA for cereals (I), other fruits and vegetables (VII), meat, poultry and fish (VIII) and eggs (IX), the ST intakes were adequate only in cereals (I) and other fruits and vegetables (VII) It could be inferred that the substantial ST intakes of meat,

TABLE 1. – *Average food adequacy (per cent)* of 368 southern Tagalog region and 15 Laguna households.*

		Food group										
Location	Number of households	I Cereals	II Starchy roots and tubers	III Sugars and syrups	IV Dried beans and nuts	V Leafy and yellow vegs.	VI Vit. C-rich foods	VII Other fruits and vegs.	VIII Meat, poultry, and fish	IX Eggs	X Milk and milk products	XI Fats and oils
Southern Tagalog	368	107	76	84	41	13	31	116	63	40	15	37
Laguna	15	114	31	89	13	14	34	124	98	93	11	37

*(Actual intake/RDA) x 100.

poultry and fish (VIII) and eggs (IX) were contributed by Laguna. The data further indicate that among the deficient food groups, starchy roots and tubers (II) and dried beans and nuts (IV) were taken in considerably greater amounts in the ST households than in the Laguna households. Intakes of sugars and syrups (III), leafy and yellow vegetables (V), vitamin C-rich foods (VI), milk and milk products (X) and fats and oils (XI) in the two samples were comparable and very inadequate.

At least 50 per cent of the households in Laguna had deficient intakes of food groups except cereals (I) of which at most 20 per cent had inadequate intake.

Per capita nutrient intakes of ST and Laguna households in percentage of adequacy are given in Table 2. Data indicate that, except for vitamin A, intakes were comparable in the two samples. Iron and niacin intakes met the RDA in both samples but vitamin A intake in Laguna households was greater than that in ST households. The difference may be attributed to the greater intakes of meat, poultry and fish (VIII) and eggs (IX) in the Laguna households.

In terms of nutrients, at least 60 per cent of the Laguna households did not meet the RDA for the nutrients except iron and niacin of which at most 43 per cent had inadequate intake. The same trend was seen in the ST households where at most 31 per cent had inadequate iron and niacin intakes and at least 64 per cent had inadequate intakes of all the other nutrients. There were more households with adequate calorie, protein, iron, thiamine and riboflavin intakes in ST households than in Laguna households. On the other hand, more Laguna households than ST households had adequate calcium, vitamin A, niacin and ascorbic acid intakes.

Nutritional contributions of the food groups in ST and Laguna dietaries are presented in Table 3. Protein intake of the ST households was mostly due to cereals (I), whereas the major portion of the Laguna protein intake came from meat, poultry and fish (VIII). Calcium intakes of both the ST and Laguna households were attributed to meat, poultry and fish (VIII) and milk and milk products (X). The iron intake of ST households was contributed largely by cereals (I); and among the Laguna households, partly by cereals (I) and partly by meat, poultry and fish (VIII) Vitamin A

TABLE 2. — *Average nutrient adequacy (per cent)* of 368 southern Tagalog region and 15 Laguna households*

Location	Number of households	Nutrient								
		Calories	Protein	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic acid
Southern Tagalog	368	79	81	31	100	39	64	37	117	83
Laguna	15	77	78	31	106	53	53	38	106	84

*(Actual intake/RDA) x 100.

TABLE 2. *Average nutrient adequacy (per cent)* of 368 southern Tagalog region and 15 Laguna households*

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Southern Tagalog	368	79	81	31	100	39	64	37	117	83
Laguna	15	77	78	31	106	53	53	38	106	84

*(Actual intake/RDA) x 100.

TABLE 3. *Nutritional contributions (per cent) of food groups: Southern Tagalog and Laguna.*

Food group		Calories	Protein	Fat	Calcium	Iron	Vit. A	Thiamine	Riboflavin	Niacin	Ascorbic acid
I Cereals	S.T	73	58	16	12	46	0	63	46	66	tr
	Laguna	41	23	9	7	23	0	37	20	28	1
II Starchy roots and tubers	S.T	3	1	1	4	5	24	5	4	2	34
	Laguna	4	1	1	3	5	21	7	2	2	20
III Sugars and syrups	S.T	6	tr	1	4	4	0	0	0	tr	tr
	Laguna	7	0	0	2	2	0	0	0	0	0
IV Dried beans and nuts	S.T	1	2	1	2	5	tr	4	3	1	1
	Laguna	2	3	3	2	5	tr	2	2	1	tr
V Leafy and yellow vegetables	S.T	tr	tr	tr	3	5	29	1	2	1	7
	Laguna	tr	1	tr	6	13	32	tr	2	1	10
VI Vitamin C-rich foods	S.T	1	tr	tr	1	3	14	2	2	1	21
	Laguna	2	1	tr	2	3	9	4	2	1	32
VII Other fruits and vegetables	S.T	4	5	2	11	11	20	11	10	4	35
	Laguna	6	5	2	13	15	26	11	10	6	35
VIII Meat, poultry, and fish	S.T	6	28	24	46	17	3	[illegible]	16	26	tr
	Laguna	26	60	56	37	30	1	24	36	59	2
IX Eggs	S.T	1	2	3	2	2	4	1	6	0	tr
	Laguna	[illegible]	2	3	2	3	5	1	7	tr	0
X Milk and milk products	S.T	1	2	4	15	tr	3	2	10	0	tr
	Laguna	3	5	4	26	tr	5	1	18	tr	tr
XI Fats and oils	S.T	5	1	46	tr	1	1	5	1	tr	tr
	Laguna	7	tr	23	tr	tr	1	11	1	1	0
Total for nutrient	S.T	101	99	10[illegible]	100	99	98	101	100	100	99
	Laguna	99	101	101	100	99	100	98	100	101	99

NOTE tr = traces ST = Southern Tagalog

intakes of both ST and Laguna households came in almost equivalent amounts from starchy roots and tubers (II), leafy and yellow vegetables (V) and other fruits and vegetables (VII). About 63 per cent of the thiamine intake of ST households was contributed by cereals (I). The same percentage of thiamine intake by Laguna households came partly from cereals (I) and partly from meat, poultry and fish (VIII). The same trend was found in riboflavin and niacin intakes. Ascorbic acid intakes in both sample households were largely contributed by starchy roots and tubers (II), vitamin-C rich foods (VI), and other fruits and vegetables (VII).

SUMMARY AND RECOMMENDATIONS

Evaluation of per capita food intake in Laguna was made by using a computer program developed by the Los Baños Computing

Center, UPCA. A comparison of food intake of ST and Laguna samples revealed that:

Whereas the ST per capita intakes were adequate for cereals (I) and other fruits and vegetables (VII), this same trend plus adequacies in meat, poultry and fish (VIII) and egg (IX) intakes were observed in Laguna.

In both ST and Laguna, only the per capita intakes of iron and niacin were found adequate. The vitamin A per capita intake in Laguna, although deficient, was greater than that in ST.

More households with adequate calorie, protein, iron, thiamine and riboflavin intakes were found in ST. On the other hand, more households with adequate calcium, protein, vitamin A, niacin and ascorbic acid intakes were found in Laguna.

The greater per capita intake of meat, poultry and fish (VII) in Laguna than in ST could account for the difference in nutrient contributions of food groups. Whereas calorie, iron, thiamine, riboflavin and niacin per capita intakes in ST came largely from cereals (I), in Laguna, these were partly due to cereals (I) and partly to meat, poultry and fish (VIII). Whereas the per capita protein intake in ST was contributed largely by cereals (I), in Laguna, this was mainly supplied by meat, poultry and fish (VIII).

These sample differences might have arisen from the small size of the Laguna subsample selected from a regional sample which might have been solely designed for evaluating the entire region. It would thus be best if sampling collection for regional surveys could be done on a provincial basis to serve as possible stratum in the sampling procedure so that more precise data can be obtained for programs in food and nutrition.

Nutrient values used in the calculations were those of raw foods so that results could be compared with the FNRC values. Since then, publications have become available on retention of nutrients especially vitamin C in preparation and cooking.[4)] Thus, these values may be used in future studies.

Recommended daily nutrient allowances used in this study were revised in 1965 by the FNRC. However, an increase in almost all allowances; namely, calories, protein, calcium, iron and vitamin C, and a reclassification of groups according to age instead of activity have been recommended.[5)]

REFERENCES

(1) Food and Nutrition Research Center, Nutrition Survey of Southern Tagalog Region, FNRC, NIST, NSDB, 1965, 88p.

(2) Food and Nutrition Research Center, Food Composition Table Recommended for Use in the Philippines, Handbook I, 3rd revision, FNRC, NIST, NSDB, 1964a.

(3) Food and Nutrition Research Center, Manual of Instruction for the Nutrition Survey, FNRC, NIST, NSDB, 1964b.

(4) L. U. Oñate, L. L. Arago, P. C. Garcia, and I. C. Abdon, *Philipp. J Nutr*, **23** (3) (1970), 34.

(5) C. Ll. Inteñgan and Technical Committee, Food and Nutrition Research Center, NIST, NSDB, *Phillipp. J. Nutr.*, **23** (2) (1970), 1.

NUTRITIONAL IMPROVEMENT OF RICE DIETS

II ESTIMATION OF FOOD INTAKES OF LAGUNA HOUSEHOLD MEMBERS BY COMPARISON WITH RDA*

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ABSTRACT

Food intake of each 17 population groups in 15 Laguna households was determined by proportion using data on RDA. As in Southern Tagalog (ST) households, many food groups were inadequately consumed by population groups. Cereals were the only food group most adequately consumed. Very active women and boys, 13-15 years old were the population groups not adequately fed with cereals. In addition to dried beans and nuts, leafy and yellow vegetables, milk and milk products, and fats and oils found most inadequate in all population groups of ST households, starchy roots and tubers and vitamin C-rich foods were among the most inadequately supplied in the Laguna population groups.

It is sometimes claimed that an individual eats what his body needs.[1] How much of these foods is consumed is also dictated by the same needs. It is also claimed that appetite, if not affected by food patterns and food availability, can lead to a nutritionally adequate diet. Thus, given sufficient amounts of different foods, people of different age, sex, and physical activity will consume them proportional to their Recommended Daily Allowances (RDA), assuming that the RDA is an accurate reflection of their needs.

To determine nutritional adequacy of diets of different Laguna household members, a ratio-and-proportion approach of computing food intakes was attempted, using the above assumption as the working premise.

PROCEDURE

Food intakes for three days of 15 Laguna households (same subsample households used in phase I,[2] were tabulated according

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to 11 food groups. Intakes of visitors and meals taken out were accounted for. Total intake per day for each food group was computed.

Household composition was tabulated according to the official 17 population groups with corresponding RDA[3] known for each household member. The RDA for the entire household was then computed. Intakes of the 17 categories of Laguna household members were derived by using the following formula:

$$\boxed{\begin{array}{l}\text{RDA for the}\\ \text{entire}\\ \text{household}\end{array}} : \boxed{\begin{array}{l}\text{Actual intake}\\ \text{for the entire}\\ \text{household}\end{array}} :: \boxed{\begin{array}{l}\text{RDA for}\\ \text{household}\\ \text{member}\end{array}} : \boxed{\begin{array}{l}\text{Intake of}\\ \text{that house-}\\ \text{hold member}\end{array}}$$

RESULTS AND DISCUSSION

Using the same method of determining adequacy of food intake including the cut-off point for defining dietary deficiency as in Phase I, the adequacy of food intake by each of the household members was computed and is presented in Table 1.

In terms of the food groups, intake of cereals (I) was inadequate only in very active women and boys of ages 13-15 years and adequate in others. Starchy roots and tubers (II), dried beans and nuts (IV), leafy and yellow vegetables (V) and vitamin C-rich foods (VI) were inadequate in all population groups. Fats and oils (XI) were inadequate in all population groups except infants for whom no RDA was given. Milk and milk products (X) were consumed in inadequate amounts for population groups for whom an RDA was given. All the other food groups were inadequately consumed by many of the population groups.

In terms of population groups, very active women and boys, 13-15 years were the most inadequately fed.

SUMMARY AND RECOMMENDATIONS

Adequacy of food intake of 17 population groups in 15 Laguna households was estimated by proportion using the Recommended Daily Food Allowances (RDA) as basis. Food groups were found inadequate in at least two population groups. Cereals (I) were the most adequately supplied; it was inadequate in intake of only two population groups. Starchy roots and tubers (II), dried beans and nuts (IV), leafy and yellow vegetables (V),

TABLE 1 – *Adequacy* of food intakes by population group. Laguna*

Household member category	Food group										
	I Cereals	II Starchy roots and tubers	III Sugars and syrups	IV Dried beans and nuts	V Leafy and yellow vegs.	VI Vitamin C-rich foods	VII Other fruits and vegs.	VIII Meat, poultry and fish	IX Eggs	X Milk and milk products	XI Fats and oils
1 Man, sedentary	131	46	52	32	6	34	125	58	210	–	52
2 Man, moderately active	104	37	196	28	41	41	61	107	270	-	55
3 Man, very active	111	31	74	20	9	20	125	65	100		24
4 Woman, sedentary	125	54	57	27	15	24	136	60	30		28
5 Woman, moderately active	124	50	88	30	18	40	121	97	240	–	58
6 Woman, very active	74	20	0	0	2	8	45	51	0	–	20
7 Woman, pregnant	101	7	57	7	6	24	88	102	113	4	3
8 Woman, lactating	138	56	118	10	24	23	64	50	233	4	44
9 Infant	130	60	110	–	20	27	80	40	133	10	
10 Child, 1-3 years	109	40	80	13	17	25	103	63	90	7	20
11 Child, 4-6 years	125	39	96	24	20	25	78	60	50	7	33
12 Child, 7-9 years	134	44	87	14	38	32	66	50	130	9	28
13 Child, 10-12 years	130	35	96	22	28	30	112	46	140	30	33
14 Girl, 13-15 years	113	44	102	30	19	31	159	47	100		31
15 Girl, 16-20 years	145	36	183	20	50	42	58	60	120		54
16 Boy, 13-15 years	75	19	0	0	2	8	45	51	0		20
17 Boy, 16-20 years	124	56	63	16	24	25	137	67	90		43

*In per cent of recommended dietary allowances (RDA)
RDA not given

vitamin C-rich foods (VI) and fats and oils (XI) were the most inadequately supplied in almost all population groups. Very active women and boys, 13-15 years were the most inadequately fed.

Estimation of adequacy of diets of population groups should be done on smaller areas in order to get a more homogeneous sample in terms of crop production and in terms of food consumption patterns.

REFERENCES

(1) C. P Richter, *Harvey Lect.*, **38** (1942), 63; M. A. Amerine, R. M Pangborn, and E. B Roessler, In Principles of Sensory Evaluation of Food, Academic Press, N Y and London, 1965, 602 p

(2) L. U. Oñate and A. R. Aguinaldo, *Philipp. J Sci*, **102** (1973) 115

(3) Food and Nutrition Research Center. Recommended Daily Food Allowances by Sex Group, Activity and Age Group Table 2 FNRC Publication No 76, 1963, 1 p

NUTRITIONAL IMPROVEMENT OF RICE DIETS

III. SUPPLEMENTATION OF LAGUNA DIETARIES WITH SOME CHEAP AND/OR EASY TO GROW FOODS*

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ABSTRACT

Effects of hypothetical supplementation of 15 Laguna dietaries on indices such as Nutrient Adequacy and Diet Rating were calculated. The step-by-step addition of one supplementary food or food combinations towards a Nutrient Adequacy of 70 per cent and Diet Rating of 90 per cent indicated the ease with which a household can achieve an adequate diet by simply including cheap or easy-to-grow foods such as *kamote* leaves and yellow tuber [*Ipomoea batatas* (Linn.) Poir].

INTRODUCTION

Available analytical data on local foods have been used as basis for grouping them according to nutritional importance. Thus, there was the original "12 Food Groups" and now there is the condensed "Basic 6" that have served as ready references for menu planning.

Baseline information on Filipino dietaries from which nutritional workers can pick out problem areas to work on is obtainable from the completed Food and Nutrition Research Center regional dietary, biochemical, and clinical surveys.[1-7] Based on these findings, recommendations for generous intake of certain foods to meet specific nutritional needs or deficiencies are made. Approaches for bringing about solutions to nutritional problems are tried, particularly in terms of teaching materials designed to elicit positive action. Thus, many nutrition education materials and guides to healthful eating are made available to rural families, the sector of our population to whom these materials will be most helpful.

This study is an attempt at evolving such a nutrition education material by illustrating how certain cheap and easy-to-grow foods,

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no matter how small the amounts, when added to typical dietaries render these diets nutritionally adequate. The ultimate aim of this study is to make people realize the striking difference a mere addition of simple but nutritious foods can make towards improvement of family's dietary.

REVIEW OF LITERATURE

Several studies reveal the nutritional potentialities of many local foods which Filipinos do not consume in adequate amounts. Soybeans (*utaw, Glycine max* Linn.) have been utilized for possible improvement of rice diets. Both green and mature soybeans were found acceptable by panels of judges when used in common Filipino recipes such as fresh lumpia.[8]

Beans were found to have high values for lysine For example, 14 0-g lysine per 100-g protein• was found in red kidney bean (*abitsuwelas, Phaseolus vulgaris* Linn.), 14.3 in green mung bean (*munggo, Phaseolus aureus* Roxb.), 12.8 in red mung bean, 12.7 in rice bean (*tapilan, Phaseolus calcaratus* Roxb.), 11.5 in chick pea (*garbanzos, Cicer arietinum* Linn.), 11 1 in lima bean (*patani, Phaseolus lunatus* Linn.), 10.9 in soybean (*utaw, Glycine max* Linn), and 10.2 in yellow mung bean.[9] Thus, beans are good supplements for cereals, the limiting amino acid of which is lysine

Chick pea (*garbanzos*) was shown to have the highest nutritional quality when compared to 11 other varieties of beans.[10] Biological value of mung bean (*munggo*), cowpea [*paayap, Vigna sinensis* (Linn.) Savi], rice bean (*tapilan*) and pigeon pea [*kadyos, Cajanus cajan* (Linn.) Mill. sp.] increased when toasted beans were fed to baby pigs [11]

Researches on the food uses of coconut were discussed by Vibar [12] and Velasco *et al* [13] Among those mentioned were coconut water for beverage and coconut milk for coffee and coco honey

Coconut protein isolate was found to be a good source of lysine.[14] Coconut flour and shrimp flour were used by Briones *et al*[15] in the preparation of crunchies which contained 28.6-g protein per 100 g. Coconut noodles prepared from wheat flour, coconut flour, and mung bean flour (50:30:10) contained 22.0-g protein per 100 g, rice noodles (*bihon*), 5 0 g per 100 g; and wheat noodles (*mike*), 12.4 g per 100 g.[16]

A review of food supplementation techniques using low-cost, high-protein food mixtures was made by Gupte.[17] Commercial preparation of food mixtures has been tried in Indonesia, India, Africa, South America and the United States. Amino acid balance of foods have been controlled by linear programming techniques.[18, 19]

PROCEDURE

The 15 Laguna households used in this study were the same households included in phases I and II.[20, 21] The FNRC dietary records of each household and the corresponding computed intakes (expressed in grams per capita per day) were examined to determine the food and nutrient groups with deficient intakes. Food and nutrient intakes that were below 75 per cent of the RDA were noted in order to narrow down the choice of supplementary foods to those which can supply the nutritional requirements. Meals and dishes served during the 3-day survey were also noted to further limit the choice to those foods which can easily be fitted in the menu without adversely affecting sensory quality of the dish or the diet as a whole.

Picked out from the list of food materials consumed by each household were those foods belonging to the deficient food groups which may not have necessarily contained significant amounts of nutrients but were taken in large quantities and those foods which have been cheap in recent years, readily available or can be easily grown in backyard gardens.

The improvement procedures were as follow:

1. Where the food material picked out contained much of the deficient nutrients, more of it in tolerable amounts was hypothetically added to the diet.

2. Where the food material picked out was not the richest or the most practical source of the lacking nutrients, other foods were hypothetically substituted for it, partially or completely displacing it in the menu.

3. Where the list did not include food materials satisfying the above prerequisites, other foods falling under the deficient food groups and rich in the lacking nutrients were hypothetically introduced in the diet in quantities presumed to be tolerable by an average consumer.

4. A combination of addition, substitution, and introduction of supplementary foods was resorted to where needed.

The foods which were added or introduced to the sample dietaries were the following: sweet potato (*kamote*) leaves and

tuber, yellow variety, horse radish tree (*malunggay*) leaves, mustard leaves, mung bean, green variety, peanuts, ripe papaya, tomatoes, *tagunton* shrimps and pig's liver. Average serving per individual was made the basis for the amount considered tolerable by a consumer.[8, 22-24]

The target of the step-by-step addition, substitution and/or introduction of supplementary foods was a Nutrient Adequacy* of 75 per cent and a Diet Rating** of 90 per cent.

RESULTS AND DISCUSSION

The case-to-case evaluation of the diets indicated that the kind and number of supplementary foods and the weights in which they were used varied widely depending on the nutritional deficiencies and the food components of the dietaries. The chemical composition of the supplementary foods used and other foods of high nutritive value are presented in Appendix I. Personal and dietary characteristics of two of the 15 Laguna households are presented in Table 1. Menus prepared by these households are seen in Tables 2 and 3. The summary of the supplementation done is given in Tables 4 and 5.

Generally, where the Diet Ratings were below 75 per cent, from six to eight foods were used, the combined total weights ranged from 146 to 472 g. Where the Diet Ratings exceeded 75 per cent, from four to six foods were used, the combined weights of which approximated 80 to 253 g.

Sweet potato tuber (yellow variety) was supplemented in all 15 dietaries to correct deficiencies in starchy roots and tubers (II) found in 13 diets and inadequacies in calorie intake found in 14 diets. The servings per person varied from 100 to 310 g per capita per day to improve ratings as low as 37 per cent and as high as 86 per cent.

Green mung bean and peanuts were used in 12 and 2 diets, respectively, to supplement dried beans and nuts (IV) found deficient in 12 diets and to augment intakes of protein, thiamine,

$$\text{*Nutrient adequacy, per cent} = \frac{\text{total nutrient intake}}{\text{recommended daily allowance}} \times 100$$

**Diet rating, per cent = Average of nutrient adequacy (per cent) of nine nutrients; namely, calories, protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin, and ascorbic acid

riboflavin, and niacin. Mung bean was used in amounts ranging from 6 to 30 g per capita per day.

Horse radish tree *(malunggay)* leaves, mustard and sweet potato leaves were used to check deficiencies in leafy and yellow vegetables (V) and inadequacies in calcium, vitamin A, thiamine, riboflavin, niacin, and ascorbic acid in 11 diets. Horse radish tree leaves were used in the amount of 30 g per capita per day; none was introduced in diets which originally included other leafy vegetables and wherein the pig's liver introduced was already sufficient to correct deficiencies in the B-vitamins. From 10 to 47 g per capita per day mustard leaves were used in diets which already originally contained them and only an increase in amount was called for. The amount of sweet potato leaves was increased to 10 g per capita per day in the diet of one household (Diet Rating, 88 per cent).

Tomatoes and ripe papaya were used as supplement in 15 and 1 diets, respectively, to check deficiencies in vitamin C-rich foods (VI) found deficient in 13 diets. Tomatoes were given in serving portions of from 16 to 60 g. Thirty g per capita per day of papaya was used in one diet (Diet Rating, 83 per cent) by increasing the original amount.

Shrimps (*tagunton*) and pig's liver were introduced in 14 and 15 diets, respectively, to raise the intake of meat, poultry and fish (VIII) and to correct inadequacies in protein, calcium, vitamin A, thiamine, riboflavin, and niacin in 11 diets. From 10 to 30 g per capita per day of shrimps (*tagunton*) were used, the minimum being given to the diet with the highest Diet Rating, 88 per cent. Only one diet was not supplemented with shrimps, the Diet Rating being already high enough, 86 per cent. Pig's liver was utilized in amounts ranging from 30 to 40 g per capital per day.

Using Diet Rating as an index of nutritive value, results indicated that supplementation increased the nutrient potential of the diets. The diet which originally had a Rating of 37 per cent, the lowest in the sample, obtained a Rating of 93 per cent or an increase of 56 percentage points with supplementary foods amounting to 473 g. The diet which initially had a Rating of 88 per cent, the highest in the sample, reached a Rating of 96 per cent after supplementation with 162 g of food.

Increase in intake after supplementation varied widely, e.g. from 831 to 911 g per capita per day (Diet Rating 79 per cent, increase of 80 g), from 500 to 718 g (Diet Rating 58 per cent, increase of 218 g), from 1,048 to 1,354 g (Diet Rating 66 per cent, increase of 306 g) and from 412 to 884 g (Diet Rating 37 per cent, increase of 472 g).

While nutrient allowances were satisfied to a level of at least 75 per cent, the data showed that supplementation was still wanting in terms of the food groups. Among the 11 food groups, excluding the miscellaneous; leafy and yellow vegetables (V) and milk and milk products (X) fell short of the recommended in all 15 households; fats and oils (XI) in 13 households; vitamin C-rich foods (VI) in 12 households; and milk and milk products (IX) in 11 households. Of the food groups that were short of the RDA, the least deficient were starchy roots and tubers (II) found deficient in 1 diet only and dried beans and nuts (IV), in 3 diets.

SUMMARY AND RECOMMENDATIONS

Hypothetical supplementation of 15 Laguna dietaries was done and the effects on indices such as Nutrient Adequacy and Diet Rating were calculated. The step-by-step addition of one supplementary food or food combinations towards a Nutrient Adequacy of 75 per cent and Diet Rating of 90 per cent indicated the ease with which a household can achieve an adequate diet by simply including cheap or easy-to-grow foods such as sweet potato leaves and yellow tuber [*Ipomoea batatas* (Linn.) Poir], horse radish tree leaves (*Moringa oleifera* Lam), mustard leaves (*Brassica integrifolia* (West) O. E. Schultz), mung bean (*Phaseolus aureus* Roxb.), peanuts (*Arachis hypogaea* Linn.), tomatoes (*Lycopersicum esculentum* Miller), ripe papaya (*Carica papaya* Linn.), shrimps (*taguntön*) and pig's liver.

There is a need, however, to test the applicability of the approach in an actual setting to support the theoretical findings obtained in this study.

A least cost-maximum nutrient model using linear programming techniques may be developed. However, to get meaningful results, a system for accurate identification of foods, complete determination of their composition, and good collection of data on costs are needed.

Programs need to be adjusted to maximize utilization of limited resources of a developing country like the Philippines. Improvement of the diet not only of households but also of regions will require the help of food and nutrition technicians, economists, and related research workers.

REFERENCES

(1) E. S. Quiogue *et al,* Nutrition Surveys of Metropolitan Manila. Food and Nutrition Research Center, NIST, NSDB, Manila, 1962.

(2) E. S. Quiogue *et al,* Nutrition Surveys of Ilocos-Mountain Province Region. Food and Nutrition Research Center, NIST, NSDB, Manila, 1963a.

(3) E. S. Quiogue *et al,* Nutrition Survey of the Cagayan Valley – Batanes Region. Food and Nutrition Research Center, NIST, NSDB, Manila, 1963b.

(4) E. S. Quioque *et al,* Nutrition Survey of Southern Tagalog Region. Food and Nutrition Research Center, NIST, NSDB, Manila, 1965.

(5) E. S. Quiogue *et al,* Nutrition Survey of Western Visayas Region. Food and Nutrition Research Center, NIST, NSDB, Manila, 1968.

(6) E. S. Quiogue *et al,* Nutrition Survey of Eastern Visayas Region. Food and Nutrition Research Center, NIST, NSDB, Manila, 1969a.

(7) E. S. Quiogue *et al, Philipp. J. Nutr.,* **22** (2) (1969b), 62.

(8) L. U. Oñate, A. R. Aguinaldo, and A. M. del Mundo, Improvement of rice diets with soybeans. Rice and Corn Research Program Tenth Annual Progress Report 1967-1968. University of the Philippines, College of Agriculture and Central Experiment Station, Laguna, Philippines, 1969, p. 226.

(9) Food and Nutrition Research Center, Food Composition Table Recommended for Use in the Philippines. Handbook I. 3rd revision, FNRC, NIST, NSDB, 1964.

(10) J. M. Gonzales, C. L. Miranda, L. D. Brennisen, and C. G. Aguilar, *Philipp. J. Nutr.,* **25** (1972), 103.

(11) J. S. Eusebio, R. R. Gonzales, J. A. Eusebio, and P. F. Alcantara, *Philipp. Agric.,* **52** (1968), 218.

(12) J. S. A. Vibar, *Chem. Q.,* **10** (1-2) (1972), 4.

(13) J. R. Velasco, O. N. Gonzales, and P. Rubio, *Chem.* **Q., 10** (1-2) (1972), 13.

(14) I. Concepcion, J. M. Gonzales, and C. Ll. Intengan, *Nutr. News,* 11 (1957), 6

(15) P. R Briones, E M. Payumo, E. A. Banzon, and M L. Torres, *Philipp J Nutr.,* **23** (1) (1970), 14.

(16) Food and Nutrition Research Center. Food Composition Table Recommended for Use in the Philippines. Handbook I. 4th revision, FNRC, NIST, NSDB, 1968.

(17) S.M. Gupte, *J. Food Sci. Technol.* (India), **9** (1) (1972), 3.

(18) G. E. Inglett, J. F. Cavins, W. F. Kwolek, and J. S. Wall, *Cereal Sci Today*, **14** (1969), 69, 72, 74.

(19) J. F. Cains, G. E. Inglett, and J. S. Wall, *Food Technol.*, **26** (6) (1972), 46.

(20) L. U. Oñate and A. R. Aguinaldo, *Philipp. J. Sci.*, **102** (1973a), 115.

(21) L. U. Oñate and A. R. Aguinaldo, *Philipp. J. Sci.*, **102** (1973b), 123.

(22) L. R. M. Sumabat, Nutrition and Dietetics. Mimeographed, 1963, 272 p.

(23) L. U. Oñate and J. S. Eusebio, Basic Nutrition Laboratory Manual, Mimeographed. Department of Home Technology, U.P. College of Agriculture, 1970.

(24) P. E. de Guzman, *Philipp. J. Nutr.*, **25** (1972), 17.

APPENDIX 1. – *Composition of foods in terms of 100 grams edible portion (E.P.).**

Source**/ Food and description	E.P.	Moisture	Food energy	Protein	Fat	Total carbohydrates	Crude fiber	Ash	Ca	P	Fe	Vit. A	Thiamine	Riboflavin	Niacin	Ascorbic acid
	Per cent	*Per cent*	*Cal*	*g.*	*g*	*g*	*g*	*g*	*mg*	*mg*	*mg*	*I.U.*	*mg*	*mg*	*mg*	*mg*
Starchy Roots and Tubers																
†Sweet potato, yellow variety [*Ipomoea batatas* (Linn.) Poir]																
Raw	88	65.0	136	1.1	0.4	32.3	0.7	1.2	57	52	0.7	900	.10	.04	0.6	35
Cooked	86	68.1	126	1.0	0.6	29.4	0.6	0.9	66	58	0.8	1025	.09	.04	0.6	31
Dried Beans and Nuts																
†Cowpea [*Vigna sinensis* (Linn.) Savi]																
Raw	84	86.7	50	3.7	0.3	8.5	2.8	0.8	114	65	1.1	1035	.17	.18	1.1	36
Cooked		86.8	52	3.0	0.5	9.1	2.9	0.6	124*	54	1.4	900	.16	.12	1.0	28
†Mung bean, green variety (*Phaseolus aureus* Roxb.)																
Raw	100	6.1	356	24.4	1.0	64.6	4.3	3.9	125	340	5.7	130	.66	.22	2.4	10
Cooked	100	60.0	150	11.0	0.3	27.1	1.3	1.6	..	209	2.6	40	.14	.06	0.6	2
†Peanuts (*Arachis hypogaea* (Linn.)																
Raw	51	49.6	274	14.1	19.4	15.5	1.1	1.4	50	194	1.9	35	.94	.20	8.0	11
Cooked	48	47.9	254	13.0	22.4	15.3	2.2	1.4	58	194	1.6	35	.56	.11	7.8	6
†Rice bean (*Phaseolus calcaratus* Roxb.)																
Raw	100	10.1	352	18.4	3.1	64.5	7.3	3.9	397	285	4.0	55	.54	.17	2.2	..

*Foods that may be used to supplement diets.

**Source

†Food and Nutrition Research Center. Food Composition Table Recommended for Use in the Philippines. National Institute of Science and Technology, National Science Development Board. Handbook I, 4th revision. 1968.

.. Not analyzed

Appendix 1 (Continued)

Source**/ Food and descrip-	E.P.	Mois- ture	Food energy	Pro- tein	Fat	Total carbohy- drates	Crude fiber	Ash	Ca	P	Fe	Vit. A	Thia- mine	Ribo- flavin	Nia- cin	Ascor- bic acid
	Per cent	*Per cent*	*Cal.*	*g*	*g*	*g*	*g*	*g*	*mg*	*mg*	*mg*	*I.U.*	*mg*	*mg*	*mg*	*mg*
Leafy and Yellow Vegetables																
†Sweet potato leaves																
[*Ipomoea batatas* (Linn.) Poir]																
Raw	53	84.8	53	2.8	0.5	10.3	2.2	1.6	107	65	6.0	5565	12	20	0.9	32
Cooked	73	93.5	.	2.6	..	..	2.4	0.8	94	45	1.5	3345	.07	11	0.5	5
†Horse radish tree leaves																
(*Moringa oleifera* Lam.)																
Raw	61	77.4	75	5.9	1.8	12.8	1.8	2.1	353	95	3.5	12450	.20	.73	3.7	232
Cooked	.	81.4	60	6.5	0.9	10.3	0.8	0.9	303	53	3.0	11515	.09	.30	1.8	134
†Mustard leaves																
[*Brassica integrifolia* (West) O E. Schultz]																
Raw	86	92.3	22	2.2	0.3	4.1	0.7	1.1	192	39	5.3	3350	.08	.14	0.6	77
Cooked		95.2	15	1.6	0.3	2.4	0.6	0.5	117	29	1.5	2820	.03	.08	0.3	41
††Sesban leaves (katuray)																
(*Sesbania grandiflora* Linn. (Pers.)																
Raw	49.2	83.7	58	6.9	2.1	6.6	1.8	1.0	168	234	2.7	3788	.81	.33	5.5	
Cooked	...	87.8	39	5.5	1.1	4.7	1.8	0.9	189	92	2.5	2736	63	.26	4.7	101
††Swamp cabbage tops																
(*Ipomoea aquatica* Forsk.)																
Raw	31	88.9	40	1.9	1.4	6.7	1.2	1.1	199	58	3.0	4347	.13	.38	1.8	71
Cooked	..	92.4	26	1.7	1.0	3.8	1.0	1.1	158	48	2.1	5380	.07	.21	1.4	26

**Source:

†Food and Nutrition Research Center Food Composition Table Recommended for Use in the Philippines. National Institute of Science and Technology, National Science Development Board. Handbook I, 4th revision. 1968.

††I. L. Oñate, L. L. Arago, P.C. Garcia, and I. C. Abdon, *Philipp. J. Nutr.*, 23 (3) (1970), 33.

Appendix 1 (continued)

Source** Food and description	E.P.	Moisture	Food energy	Protein	Fat	Total carbohydrates	Crude fiber	Ash	Ca	P	Fe	Vit. A	Thiamine	Riboflavin	Niacin	Ascorbic acid
	Per cent	*Per cent*	*Cal*	*g*	*g*	*g*	*g*	*g*	*mg*	*mg*	*mg*	*I.U.*	*mg*	*mg*	*mg*	*mg*
**Vitamin C rich Foods*																
Philippine lemon (*Citrus microcarpa* Bunge)	38	89.8	32	0.4	1.0	8.3	tr.	0.5	18	12	0.8	0	.02	.01	0.2	45
†††Citrus (*Citrus nobilis* Lour.)	*44*	*91.8*	*21*	*0.4*	*0.2*	7.3	0.1	0.3	32	8	0.3	74	.04	.03	0.1	51
†††Guava (*Psidium guajava* Linn.)	99	89.1	39	0.5	0.2	10.0	1.8	0.2	30	16	3.6	-	.03	.04	0.9	120
†††Mango (*Mangifera indica* Linn.)	47	81.9	28	0.7	0.2	6.8	0.3	0.4	10	26	0.5	770	.09	.08	0.6	52
†††Papaya (*Carica papaya* Linn.)	71	85.3	59	0.5	0.3	13.5	0.9	0.4	42	14	1.3	580	.02	.04	0.7	68
†Strawberry (*Fragraria vesea* Linn.)	98	91.3	30	0.8	0.2	7.2	1.6	0.5	34	21	1.2	15	.03	.03	0.3	107
†Tomatoes (*Lycopersicum esculentum* Miller)																
Raw	95	94.1	19	1.0	0.2	4.1	0.8	0.6	18	18	0.8	735	.06	.04	0.6	29
Cooked	96	93.5	..	1.0	..	.	0.8	0.6	39	26	1.5	870	.05	.04	0.6	26
Meat, Poultry, and Fish																
†Liver, pig's (*Sus scropa* Linn.)																
Raw	..	73.4	123	18.0	2.8	5.4	..	1.4	..	267	14.0	14670	.35	1.79	13.2	23
Cooked	..	71.7	131	17.6	3.7	5.9	..	1.1	..	300	10.8	..	.08	.41	5.5	
†Shrimps, tagunton																
Raw	100	74.4	103	20.2	1.9	(0.0)	.	3.5	2351	382	15.2	295	.02	20	2.7	

**Source

†Food and Nutrition Research Center. Food Composition Table Recommended for Use in the Philippines. National Institute of Science and Technology, National Science Development Board. Handbook I, 4th revision. 1968.

†††Based on results of the National Research Council Grant to the U.P. College of Agriculture. 1972.

TABLE 1. *Personal and dietary characteristics of sample households: Laguna.*

Household no.*	Classification	Household size			Occupation of household head	Deficient food group	Deficient food nutrient
		Total	Infants	Children 1-12 years			
1	Urban	7	0	5	Coconut husker (no)†	All, except Cereals (I)	All, except niacin
2	Rural	6	1	2	Farmer (yes)	Starchy Roots and Tubers (II) Vit. C-rich Foods (VI) Other Fruits and Vegetables (VII) Meat, Poultry and Fish (VIII) Fats and Oils (XI)	All, except calories, niacin, ascorbic acid

*Code No. 04 and 14.

†Engaged or not in vegetable gardening.

TABLE 2. – *Menu prepared by sample household* for 3 days Laguna*

Meal	Household No. 1: Diet rating = 46 per cent		
	Tuesday	Wednesday	Thursday
Breakfast	Rice Coffee with sugar and milk	Rice Coffee with sugar and milk Bread (2 types)	Rice Coffee with sugar Fish (gurami), fried, L.O. Bread (2 types)
Snack	–	Cake (mamon rolls) Sweet potato, Soda crackers	Peanuts
Lunch	Rice Fish (gurami), sarciado Fish (gurami), fried	Rice Fish (gurami), fried, L.O.* Fish (dalag), sinigang	Rice Fish (dalag), guinataan
Snack	–	–	Cake (mamon rolls)
Supper	Rice Fish (ayungin), paksiw	Rice Fish (dalag), sinigang, L.O.	Rice Fish (gurami), fried, L.O.
Snack	–	–	–

*Code No. 04.
NOTES: L.O. means left-over
Paksiw is fish or meat cooked with vinegar. Spices usually included are garlic and ginger
Halabos is shellfish cooked in water until most of the water is evaporated
Sinigang is fish or meat cooked with a souring agent such as tomatoes, guava, green tamarind, or balimbing
Sarciado is fish or meat with sauce usually prepared with tomatoes and sometimes with garlic and onions
Guinataan is a dish prepared with coconut milk
Guisado is a dish with garlic, onion and tomatoes cooked in fat or oil Ingredients are added one at time until slightly brown

TABLE 3 *Menu prepared by sample household* for 3 days Laguna*

Meal	Household No 2 Diet rating – 59 per cent		
	Tuesday	Wednesday	Thursday
Breakfast	Rice Fish (kabasi), fried Cocoa with sugar Bread	Rice Shrimps (tagunton), fried Fish (ayungin), fried, L.O Bread Biscuit Cocoa with sugar	Rice Fish (hito), fried Fish (pantat), fried Cocoa with sugar
Snack		Yam bean	Cookies, ice drop Wafer
Lunch	Rice, red Fish (ayungin), sinigang Sweet potato, guinataan	Rice Shrimps (tagunton), fried, L.O Fish (dalag), fried Sweet potato, boiled with sugar	Rice Fish (hito), fried
Snack	–	Suman sa ibos Crude sugar (panocha) Sweet potato, boiled	
Supper	Rice Fish (ayungin), fried Banana lakatan	Rice Fish (dalag), fried Shrimps (tagunton), fried, L.O	Rice Fish (dalag) broiled, L.O
Snack	Crude sugar (panocha)		–

*Code No. 14

TABLE 4 – *Supplementation of diet in sample household Number 1: Laguna*

Group	Food in original diet	Food adequacy (Per cent)	Supplementary foods	Nutrient adequacy (Per cent) Nutrient	Before	After
I	Rice (253),** bread (38)			Calories	63	87
	cake (I), soda crackers (I)	133		Protein	67	100
				Calcium	12	75
II	Sweet potato tuber (9)	8	Sweet potato tuber (144)**	Iron	66	100
III	Sugar (13)	37		Vitamin A	23	100
IV	Peanuts (2)	3	Peanuts (19)			
			Mung bean (30)	Thiamine	41	100
V	Mustard leaves (5)	8	Mustard leaves (5)	Riboflavin	23	95
			Horse radish tree leaves (20)	Niacin	97	100
VI	Tomatoes (7)	7	Tomatoes (53)	Ascorbic acid	22	100
VII	Onion (tr), garlic (tr), ginger (tr), melon (21), tamarind green (7)	21		Average (Diet rating)	46	95
VIII	Fish – gurami (112), fish, grunt silver – ayungin (17), fish, mudfish – dalag (27)	59	Shrimps, tagunton (20), liver pig's (30)			
IX		0				
X	Milk (8)	7				
XI	Coconut oil (1) Coconut milk (7)	11				
XII	Coffee (1), salt (5) Monosodium glutamate (tr)	–				

*Code No. 04

**Figure in ( ) refers to amount (g per capita per day). Amounts of foods and adequacy are rounded for ease in presentation

tr – less than 0.5 g.

TABLE 5 – *Supplementation of diet in sample household Number 2 Laguna* *

Group	Foods in original diet	Food adequacy (Per cent)	Supplementary foods	Nutrient adequacy (Per cent)		
				Nutrient	Before	After
I	Rice, red (60) ** rice (252) bread — pan de sal (12), biscuit (2) suman sa ibos (8), cookies (2), wafer (1)	145		Calories Protein Calcium	86 70 29	100 100 86
II	Sweet potato tuber (94)	78	Sweet potato tuber displaced white tuber (150)	Iron	77	100
III	Sugar (31), sugar, crude — panocha (10)	107		Vitamin A	6	100
IV		0	Mung bean (30)	Thiamine	47	100
V		0	Horse radish tree leaves (30)	Riboflavin Niacin	28 94	100 100
VI	Tomatoes (6)	7	Tomatoes (54)	Ascorbic acid	91	100
VII	Ginger (tr), garlic (tr), banana — latundan (18)	37		Average (Diet rating)	59	9[illegible]
VIII	Shrimps, taganton ([illegible]), fish, short — finned gizzard shad — kabasi fish, grunt silver — ayungin (10), fish mudfish — dalag (24) fish fresh water, catfish — hito fish — pantat (9)	61	Shrimps, taganton (20), liver, pig's (30)			
IX		0				
X		0				
XI	Vegetable oil (19), coconut milk (4)	3				
XII	Cocoa (1), salt (2), ice drop (3)	—				

*Code No. 14

**Figure in ( ) refers to amount in g per capita per day. Amounts of food and adequacy are rounded for ease in presentation.
tr — less than 0.5 g

AN ARCHAEOLOGICAL FIND IN THE PHILIPPINES: A FRUIT OF THE GENUS *PSIDIUM* (GUAVA)

By HERMES G. GUTIERREZ
Curator, Philippine National Herbarium, National Museum

ABSTRACT

The putative introduction of the genus *Psidium* (guava) in the Philippines is discussed in connection with an archaeological finding consisting of a fruit in a 15th century Early Ming bowl. The excavation was undertaken in an ancient burial site in Bolinao, Pangasinan, Luzon.

A myrtaceous fruit which belongs to the genus *Psidium* was recently discovered inside a 15th century Ming bowl excavated in an archaeological site in Bolinao, Pangasinan, Luzon. This finding was brought to our attention in the Botany Division (Philippine National Herbarium) by Mr. Avelino Legaspi, archaeologist of the Anthropology Division, National Museum, who discovered the specimen. The fruit bears the catalogue number Blg-1, GR-14, 64-p51 in the anthropology division collection. Similarly, the bowl has Blg-1, GR-14-3, 64-F-48 for its number. According to Dr. Robert B. Fox, former chief of the Division of Anthropology, National Museum, the bowl is Early Ming, probably of the 15th century, which is undoubtedly pre-Spanish. The fruit was found inside the bowl placed near the shoulder of the skeletal remains in an inverted position.

While the fruit is that of a *Psidium*, it is rather difficult to determine its specific position in the genus simply because the fruit which is commonly called "bayabas" in local dialects comes in many sizes and in different intergrading shapes.

This important finding, however, might shed some light to our knowledge and understanding about the migration and introduction of the plant to the Philippines.

Although the guava, *Psidium guajava* Linn., is known to have been introduced by the Spaniards in the Philippines after 1521 from South America, it is not known whether the same species or some other forms might have been introduced earlier from India

through Malaysia. It is possible that it might have even followed other routes of migration. While it is easily carried by man in his migration, the fruits or the seeds can also be readily dispersed by animals.

Burkill[1)] states that along with other names the "guajavas" has been used in Southern India. But the name has not established itself in the vernacular languages. If at all, the plant in Malaysia came from India, the name is not even commonly used by Malays. On the other hand, the Malays used the name "jambu" for guava, which is a word that came from India through Java. The acceptance of the name "jambu," however, was established long before the guava was known to them. Burkill regards the guava in India as an immigrant, in the main, from the west, whereas in Malaysia, at least in the eastern parts, it was an immigrant from the east.

In the Philippines, the name "bayabas" is definitely a word derived from the "guajavas" of Indians and Spaniards. The name is so common in the country that it has even established itself in some dialects. For instance, the Tagalogs have coined the word "Malabayabas" to refer to some indigenous or even endemic species which in general have semblance with the guava, particularly the leaves. The word almost instinctively presumes that the hearer knows the guava. For some reason or another, the word has been formed and used by the more informed segment of the society for purposes of convenience in the local identification of "native" trees that have economic importance. In all cases, when there are native inhabitants in the locality, all the plants around them have their own common or local names. This view refers only to endemic and indigenous species.

The "bayabas" represents a wide variety of forms existing in the country, coming in many sizes and in different shapes from globose to ellipsoid or obovoid to pear-shaped. From this condition, one cannot rule out the fact that the environment has something to do with it. In abandoned clearings (kaingin), one can observe at times guavas that have become diminutive, otherwise big when they were still tended by the settlers. It is not also an uncommon experience to have observed backyard trees once bearing relatively large fruits reverting to small ones when neglected.

Merrill's[2] list considers only two species in the Philippines, *Psidium cujavillus* Burm.f. and *Psidium guajava* Linn., both introduced supposedly from tropical America. The first species has no common name and cited to have been collected in Rizal, Luzon, "in thickets at low and medium altitudes, apparently very rare or local in the Philippines." The second species, however, has many common names, from different dialects, but which are decidedly derived from the name "guajavas" such as "bayabas," "biabas," "gaiyabat," "geyabas," "tayabas," etc. However, there is one name "kalimbahin" which is used by the Tagalogs that does not at all sound like the Indian or Spanish name. In the Index Kewensis,[3] the species name *P. cujavillus* Burm. f. is a synonym of *P. guajava* Linn. Since Rizal (Luzon) is a Tagalog province, the name "Kalimbahin" would mean any form of guava as far as the Tagalogs are concerned.

This 15th century *Psidium* fruit, therefore, may or may not have come from the species *Psidium guajava* Linn. However, the guava irrespective of the species to which it belongs was already in the Philippines long before the coming of the Spaniards.

REFERENCES

(1) I. H. Burkill, A Dictionary of Economic Products of the Malay Peninsula, London, Crown Agents for the Colonies, 1935, Vol. II (I-Z), p. 1815.

(2) E. D. Merrill, An Enumeration of Philippine Flowering Plants, Philippine Bureau of Science, Publication No. 18, 1923, Vol. III, p. 154.

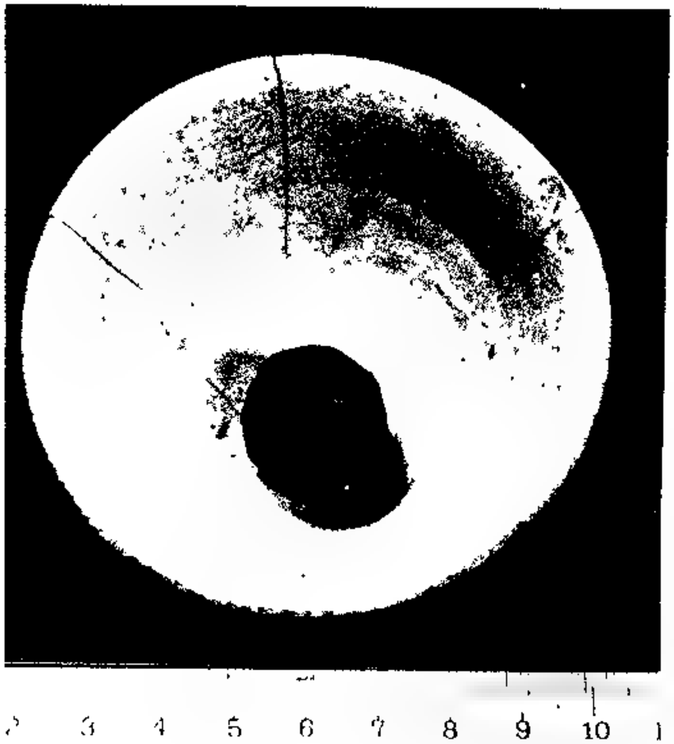
(3) J. D. Hooker and B.D. Jackson, Index Kewensis, Great Britain, University Press, Oxford, 1895, Vol. II (K-Z), p. 640.

ILLUSTRATIONS

PLATE 1

Fig. 1. The fruit in the 15th century bowl found associated with skeletal remains in an early Filipino burial site.

2. The fruit in cross-section showing the relatively large seeds.



1

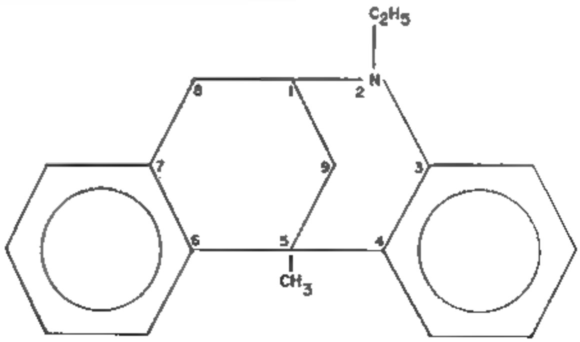
2

Plate 1

In the IR spectrum absorption bands at 1625 cm^{-1} and 1610 cm^{-1} were observed which have been described as characteristic positions for benzomorphans.[6]

Based on NMR, IR and analytical values and compound was assigned the structure as 2-ethyl-5-methyl-3,4:6,7-dibenzomorphan.

FORMULA



REFERENCES

(1) A. Surana, D. Kishore, and B.C. Joshi, Die Naturwissenschaften, 1973, Vol. **60**,,p. 388.

(2) R. Grewe and A. Mondon, *Ber. Deutsch Chem. Ges., B* **81** (1948), 279

(3) a. R. Ramchandran and B.C. Joshi, *Def. Sci. J.* (*India*), **20** (4) (1970), 233.

b. B.C. Joshi, C.F. Chignell, and E.L. May, *J. Med. Chem.*, **8** (1965), 694.

(4) W. Bradley and S. Jeffery, *J. Chem. Soc.* (1954), 2770.

(5) D. Kishore, Ph.D. Thesis, University of Rajasthan, 1970.

(6) J.H. Ager, S.E. Fullerton, E.M. Fry, and E.L. May, *J Org. Chem.*, **28** (1965), 2470.

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NOTES ON PHILIPPINE MOSQUITOES, XVI. GENUS TRIPTEROIDES. By F. E. Baisas and Adela Ubaldo-Pagayon. Institute of Science and Technology Monograph 2 (1952) new series. Paper, 198 pages with 23 plates and four text figures Price $2.50, United States currency.

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